Applying a Systems Approach to Cultivating, Strengthening and Sustaining NASA Partnerships

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Applying a Systems Approach to Cultivating, Strengthening and Sustaining NASA Education Partnerships

Outline

- **Global Context & STEM Crisis in America**
  - Living in Revolutionary Times of Tumultuous Change
  - Growing Recognition of STEM Crisis in America: Danger and Opportunity

- **Opportunity: NASA's Response to Crisis**

  NASA's Partnership Planning Group will use the New Education Framework to inspire and to empower leaders as Innovation Change Agents and Advocates of a Systems Approach to address the three priority goals of Education and Cultivate and Sustain NASA Partnerships
  - Understanding Relevance and Value of Systems Thinking
  - Proposing a Systems Approach for NASA Partnership Planning Group:
  - Manage a Systematic, On-going, Futures Focused Communication Process

- **Appendices**
  - Appendix A: Living in Revolutionary Times of Change
  - Appendix B: American Competitiveness Challenge
  - Appendix C: Papers & Presentations – identified by Alabama MSTE Coalition
  - Appendix D: Champions of Systems Thinking
  - Appendix E: Partnership Development Process- Lowenstein & Melnick
  - Appendix F: Resource Bibliography

I. Global Context & STEM Crisis in America

A. *Living in Revolutionary Times of Tumultuous Change*

- ***Future Shock (Alvin Toffler)***
- ***Between the Parentheses (John Naisbitt)***
- ***State of Hyperturbulence (Harold Shane)***
- ***The 'Liminal Moment' (Sherry Turkle)***

B. *Growing Recognition of STEM Crisis in America: Danger and Opportunity*

- ***The World is Flat: A Brief History of the 21st C (Thomas Friedman)***
- ***America's Competitiveness Challenge: Who will lead world in Innovation? How do we retain education and economic security? (Appendix B)***
- The Gathering Storm defined in variety of reports (See Appendix C)

II. Opportunity: NASA Responds to Crisis with the New Education Framework and a Systems Approach to its Implementation.

NASA's Partnership Panning Group will use the New Education Framework to inspire and to empower leaders as Innovation Change Agents and Advocates of a Systems Approach to address the three priority goals of Education and Cultivate and Sustain NASA Partnerships

A. Understanding Relevance and Value of Systems Thinking

Champions of Systems Thinking (Appendix D)

- **Peter Senge Author, Champion of The Learning Organization**
- **Industry Champions – e.g., Rick Stevens**
- **Marhall Approach & References – e.g, Sterman article**

B. Proposing a Systems Approach for NASA Partnership Committee: Managing a Systematic, On-going, Futures Focused Communication Process

-- that provides scalable approaches that empower NASA leadership

-- that fosters an Ecology of Community Transformation

B.1 Overview

- NASA HQ will adapt the Futures Research Methodology, ("Delphi Research Methodology') to initiate an on-going Systems Model of Communication with and among the 10 NASA sites.
- Headquarters (HQ) will guide the establishment of a Systems Model of Inquiry that simultaneously explores complex issues of Partnerships at each of the sites.
- Each site will invite a Futures Panel, composed of broad base of community stakeholders, to engage in an iterative cycle of reflection, inquiry, and synthesized feedback, followed by further probing and feedback. Each site will analyze and synthesize the Rounds of Data Collection on a particular issue to create a Final Site Report to be submitted to HQ.
- HQ will aggregate results/ judgments from the Sites and their NASA Futures Panels on an on-going basis and create an ***Annual State of the NASA Education Future: Celebrating Partnerships,*** and other special reports that can be used by decision-makers, policy leaders and educators across the US.

B.2 Further Clarification of the Process

- HQ will provide training, guidelines and technical assistance to the Sites, while each site will have autonomy for the creation of their own Partnership Futures Panel, the conduct of the investigation and creation of Final Report.
- Each site will have a Moderator to coordinate the on going inquiries, and have responsibility for creating a **Partnerships Futures Panel** composed of a diverse group of stakeholders who share common interest in strengthening NASA and the Nation's future workforce, attracting and retaining students in STEM Disciplines and engaging the public in NASA's Mission, though Panelists can be geographically dispersed, & possess variety of perspectives
- **An incentive for Potential Panelists** to serve on a Futures Panel is the opportunity to express and reassess their own beliefs, based on a review of the group's judgments, with the understanding that the ideas generated will be widely disseminated among decision leaders and hence, will have some impact on determining future policies and programs in NASA –Education.

B.2 Further Clarification of the Process

- **Guidelines for Panel Selection**: Experience of researchers, like Lowenstein and Scheele, indicate that a successful mix of Panelists will involve 3 types of individuals: (1) **practitioner stakeholders**, those who are or will be directly affected; (2) **experts**, those who have an applicable specialty or relevant experience; and (3) **facilitators**, those who have skills in clarifying, organizing, synthesizing, stimulating, and /or individuals who can supply alternative global views of the culture and society. Other criteria include ensuring there is **diversity in ideas**, as well as **representation from each of the following groups: government, private sector, community based groups, Education K-12, Higher Education and Informal Education.**
- **Nature of inquiry:** HQ will also define the time frame and the series of topics and questions used during the iterative cycles, eg., (a) Next generation education products/projects; (b) Best Practices in STEM Education; (c) Strategies that Open the STEM Education Pipeline; (d) Effective strategies for engaging the public in NASA's mission.; (e) Models for Cultivating Private Public Partnerships

B.2 Further Clarification of the Process

- Generally inquiries begin with broad questions that address big picture concerns, and then those issues are further probed to solicit views of priority rankings, implementation factors, time frames, etc.

- NASA HQ will coordinate the process, aggregate data from the multiple reports from NASA Sites, create a final report and arrange an annual presentation in D.C. This culminating report will not only enable the entire community of Panelists and NASA Sites to learn from and share with each other, but also to share with National policy leaders. Reports obviously can be disseminated using variety of media outlets, websites, etc..* Communication and public outreach are vital consideration throughout.

B.3 Process and Product Benefits

Process benefits:

- Establishing an on-going mechanism to continuously promote reflection/inquiry-research with diverse group of experts/ stakeholders across the country, including the 'new segments of education community;
- Fostering community/ coalition building- Consensus can be cultivated, even when outlier views are solicited.
- Embracing broad base of stakeholders reinforces values of NASA Partnership Planning Group; the organizational approach also conveys respect for diverse views of individuals as well as respect for the autonomy of NASA's local and regional partners while maximizing the power of a national focus.

Product benefits:

- The final reports provide a powerful aggregation of data from experts and stakeholders rarely tapped;
- Final Reports also have a validity and power far greater than usual survey.

B.4 Relevance of Approach to Summit:

- Use Summit to Highlight NASA's New Education Framework and Systems Approach to its Implementation

- Design the Summit to model the values and beliefs of the NASA Partnership Planning Forum.

Appendices

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APPENDIX A

Living in Revolutionary Times of Change

- **An Excerpt from Out of the Box and Onto the Web: A Guide for using Telecommunications Technology Partnerships to Create Systemic Change. Lowenstein & Melnick. Alexandria, VA: National Association of Partners in Education, 1999.**

Science and the new technologies have propelled us out of the Industrial Age into a knowledge driven Information and Digital Age. … Many of the changes were prophesied even as they began to ripple through society:

- **In his best seller, FUTURE SHOCK (1970), Alvin Toffler described how individuals would feel when subjected to 'waves of change that would come faster and faster' as 'too much change in too short a time.'**
- **In his national best seller, MEGATRENDS (1982), John Naisbitt detailed the dramatic and fundamental restructuring of American society from an industrial age of production to a post-modern age of services and information which he characterized as '*living between the parenthesis.*'**
- **In 1987, education historian and futurist Harold Shane observed that such rapid change had thrust society past what Toffler labeled future shock into a state of 'hyperturbulence,' where institutions and resources are inadequate to deal with the acceleration of those changes;**
- **In 1995, MIT sociologist and cyberspace anthropologist Sherry /Turkle observed that we are poised between th second and third wave of civilization in a '*liminal moment,*' a time when things are between and betwixt, where old structures have broken down, and new ones have not yet been created.**

…. As we partners of education reform grapple with the tumultuous times of change and the challenges of the Information Digital Age, let us use the Internet as a concrete tool for connection, as well as a figurative metaphor for thinking and behavior. ***Let the visual image of the Web inspire us to expand our thinking in new non-linear ways. Let us get out of the box, relinquish the constraints of the Industrial Age mentality and establish more holistic, inter-relational systems of possibilities***

American Competitiveness Challenge

President George Bush, at Montgomery County Public School, April 2006:

"Education is the Gateway to Opportunity and the Foundation of a Knowledge-Based, Innovation-Driven Economy."

American Competitiveness Initiative: Encouraging Innovation

To prepare Americans to compete more effectively in the global marketplace, the ACI proposes $380 million in new Federal support to improve the quality of math, science, and technological education in K-12 schools and engage every child in rigorous courses that teach important analytical, technical, and problem-solving skills

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APPENDIX C

American Competitiveness Initiative: Leading the World in Innovation	2006	Domestic Policy Council, Office of Science and Technology Policy
Assessing the U.S. R&D Investment: Findings and Proposed Actions	2002	The President's Council of Advisors on Science and Technology
Before It's Too Late: A Report to the Nation	2000	The National Commission on Mathematics and Science Teaching for the 21st Century
Broadening Participation in Science and Engineering Faculty	2003	National Science Board, National Science Foundation
A Commitment to America's Future: Responding to the Crisis in Mathematics & Science Education	2005	Business -- Higher Education Forum
Ensuring Workforce Skills of the Future: The Birth to Work Pipeline	2003	Rick Stephens and Elane V Scott, The Boeing Company
Innovate America: Thriving in a World of Challenge and Change (Executive Summary)	2004	Council on Competitiveness
Investing in U.S. Innovation	2005	The National Summit on Competitiveness:
The Knowledge Economy: Is the United States Losing It's Competitive Edge?	2005	The Task Force on the Future of American Innovation
Learning for the Future: Changing the Culture of Math and Science Education to Ensure a Competitive Workforce	2003	Research and Policy Committee of the Committee for Economic Development
Losing the Competitive Advantage? The Challenge for Science and Technology in th United States	2005	American Electronics Association
Middle School Texts Don't Make the Grade	2003	John Hubisz, Physics Today
Meeting the Challenge of a Changing World: Strengthening Education for the 21st Century	2006	U.S. Department of Education

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APPENDIX C

The Neuroscience of Learning	2006	Kenneth Wesson
Perhaps You Were Wondering Why We Called This Meeting…	2006	AMSTEC Governor's Summit Planning Team
The Quiet Crisis: Falling Short in Producing American Scientific and Technical Talent	2002	Shirley Ann Jackson, PhD, President, Rensselaer Polytechnic Institute, for BEST (Building Engineering & Science Talent)
Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future	2005	The National Academies: National Academy of Sciences, National Academy of Engineering, and Institute of Medicine
Road Map for National Security: Imperative for Change	2001	The United States Commission on National Security / 21st Century
The Science & Engineering Workforce: Realizing America's Potential	2003	National Science Board, National Science Foundation
Sharing Responsibility: How Leaders in Business and Higher Education Can Improve America's Schools	2001	Business – Higher Education Forum (BHEF): A Partnership of the American Council on Education and the National Alliance of Business
Strengthening Education: Meeting the Challenge of a Changing World	2006	U.S. Department of Education
Tapping America's Potential: The Education for Innovation Initiative	2005	Business Roundtable and Others
Transcript of NSB Hearing December 7, 2005	2005	National Science Board

Champions of Systems Thinking

In the past fifty years, a variety of authors and practitioners in business, government and education have begun to champion systems thinking as a strategy to address the large scale challenges in a world that is increasingly complex, dynamic, and globally competitive. The Belief Systems articulated by author **Peter Senge, Boeing VP Rick Stephens, Consultant Elane Scott, MIT Sloan School of Management Professor John Sterman, Marshall Space Flight Center Leadership,** are quite consistent, whether they are addressing policies related to *21st C Aerospace/STEM Education Workforce Needs; American Competitiveness Agenda, strategic goals of NASA Education locally or globally or to other policy areas such as Public Health.*

Their views reinforce the value of NASA HQ adapting a Systems Approach of addressing Diversity Partnership Goals, and managing an on going communication process among broad base of stakeholders across the nation, and foster a systematic process of partnership development.

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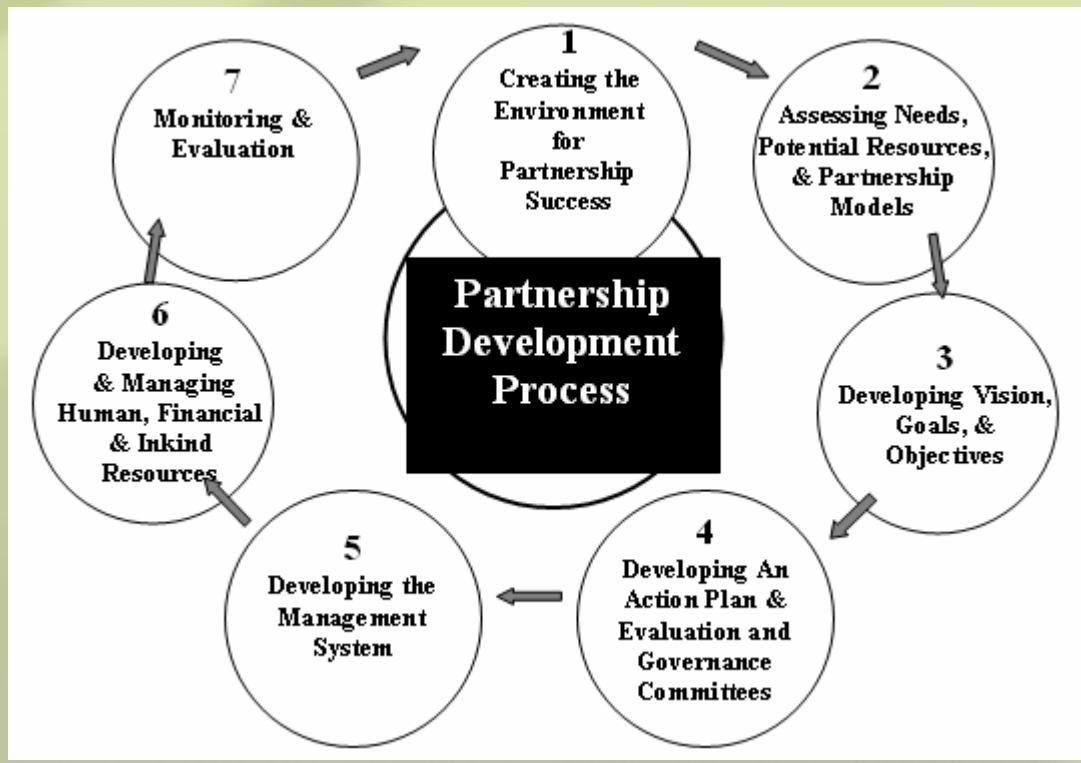
APPENDIX D

Some Shared Beliefs:

- Rick Stevens, Elane Scott, and Marshall Space Flight Center leaders recognize the power of fostering an Integrated Stakeholder Coalition for Workforce Development and using a systems integration approach, "the same approach that built the Space Shuttle and the International Space Station."
- They assert that all stakeholders, including educators, policy leaders in government, private sector and community based groups, have responsibility to address the challenges, engage in collaborative learning and decision making: "The answers we seek must be born out of the thinking of all of us."(Rick Stephens).
- They perceive the world as full of dynamic complexity for which conventional forecasting, planning and analysis methods are inadequate: Essential to release linear, unidirectional causation way of thinking, and adopt the systemic perspective to address the dynamic complexity of the interactions of today's world. (Senge, Sterman)
- They insist on viewing STEM Education within a totality that extends beyond formal school environments and embraces the culture, media and community as a whole.
- Peter Senge's works has been seminal: In The Fifth Discipline: The Art & Practice of The Learning Organization (New York: Currency Doubleday, 1990), 371 p. he defines the need for "learning organizations," where people continually expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where people are continually learning how to learn together. He then describes five disciplines as the means of building learning organizations., with Systems thinking being the fifth discipline that fuses the others, including Personal mastery (constantly clarifying our personal vision), Mental models (examining our internal pictures of the world), Building shared vision (foster genuine commitment versus compliance), Team learning (dialogue and thinking together).

Partnership Development Process (Lowenstein & Melnick)



APPENDIX E

Partnership Development Process (Lowenstein & Melnick)

The development process pictured above is a research-based model that serves as a guide for developing effective partnerships. It has evolved from more than 30 years of experience and research by partnership practitioners from education, business and the community who have a passionate commitment to improving the educational success of all students through effective community involvement. The process has a number of important characteristics to keep in mind as you move through your partnership development journey.

A cyclical process ***with seven stages*** While the process follows a set of stages, each stage informs the others. As you work through the stages, it is important to be open to changes as new data and insights inform and affect the whole process. As additional information emerges, changes can be incorporated in any stage. As each annual planning cycle proceeds, the stages of development need to be revisited and refined as the partnership matures and becomes more sophisticated.

Consensus-based decision-making In the partnership development process, emphasis is placed on collaborative decision-making. A key role of the core planning team or the formal governance committee is to continuously check with key stakeholder groups and task force members to see that consensus has been reached on decisions important to the future of the partnership initiative. Participatory consensus-building methods are imbedded throughout this process.

Active participation of the stakeholders The active participation of a broad-based group of stakeholders is critical to the success of this effort from the start. Tools, techniques and methodologies are built into this process because of their usefulness in facilitating collaboration and active participation. This gives each stakeholder group not only the right to be a part of the partnership initiative, but also responsibility for particular activities and overall results of the partnership effort. This active participation ultimately leads to the acquisition of the necessary human and financial resources to sustain the initiative and achieve significant outcomes.

Big picture thinking *The partnership development process begins with big picture thinking about purpose and vision and then narrows to specific objectives and actions and finally returns to the big picture with documentation of major outcomes related to achieving the vision. In Stage 1 participants clarify their purpose for working together in partnership. This allows them to articulate their joint mission and provides an overarching context for the partnership effort. After engaging in analysis and research in Stages 1 and 2, participants are ready to move into the planning Stages 3, 4, 5, 6, and 7. In Stage 3 the participants develop a vision, goals and objectives and in Stage 4, an accountability-based action plan. In Stages 5, 6, and 7 they develop plans for a management system, development and management of human and financial resources, and an evaluation process. It is extremely important to complete the planning for Stages 3 to 7 before beginning program implementation. This planning provides the organizational foundation. As outcomes are documented, they are linked back to the statements of purpose and vision, which reflect the big picture. This allows the stakeholders to observe the long-term implications or legacy of their effort***.***

An upward spiraling process. The process allows for incorporating the lessons and successes of each of the previous stages and of each complete 'revolution' (i.e. having completed the 7 stages). As each revolution of the planning stages is completed, the deepening levels of accomplishment spiral upward so that each stage is now revisited and revised at an increasingly mature level of collaboration.

A generic process The process is applicable to developing any collaborative endeavor that calls for a broad base of stakeholder participation and consensus to address and deal with anything from simple to highly complex community development issues.**!**

APPENDIX F: Resource Bibliography

Thomas L Friedman: The World is Flat: A Brief History of the 21st C. (2005) New York: Farar, Straus, & Giroux, 2005.

Ronnie Lowenstein: books and workshops promoting Partners in Education's systematic 7 Step Approach to Partnership Development. ….

> Out of the Box and Onto the Web: A Guide for using Telecommunications Technology Partnerships to Create Systemic Change. Lowenstein & Melnick. Alexandria, VA: National Association of Partners in Education, 1999.
>
> *Technology & Partnerships: Tools for Reconceptualizing & Restructuring Education,"* Lowenstein, R. in Creating Connected Communities: Telecommunications Partnerships for the 21st Century. Asche, Lowenstein, & Melnick. Alexandria, Virginia: National Association of Partners in Education, 1997.
>
> Integrating Telecommunications Technology into Education: The 21st Century Challenge for Partners Navigating the Four Cs of Change. Lowenstein & Asche. Alexandria, VA: National Association of Partners in Education, 1996.

Peter Senge The Fifth Discipline: The Art and Practice of the Learning Organization (1990): New York: Currency Doubleday

John D. Sterman. *Learning from Evidence in a Complex World*," American Journal of Public Health (Vol 96. No. 3), March 2006.